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WHY DRINK FROM A FIREHOSE WHEN ALL YOU WANT IS A
GLASS OF WATER?

MANAGING KNOWLEDGE FOR DECISION MAKERS

by

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Abstract

A Major Command generates a vast amount of information and this volume is growing exponentially. The increase in operations tempo and short notice deployments require the rapid fusion of this information to ensure a quick response and decisiveness in any crisis. The Air Force needs a system that allows commanders to sort through the flood the information, find the insight they need, and quickly make the right decisions. This paper focuses on the field of knowledge management and the technological benefits of thin client architecture, intranets, and the World Wide Web. It also explores ways to improve the knowledge base available to MAJCOM, NAF, and Wing Commanders and their senior staffs. In addition, this paper makes recommendations for Air Force implementation of knowledge management solutions so that the Air Force can evolve into an ever more potent information superiority force. It is now time for the Air Force to embrace knowledge management as a requirement for operating effectively in the 21st century.

Part 1

Introduction

An investment in knowledge pays the best interest.

— Ben Franklin¹

According to *U.S. News and World Report*, information is now doubling every two and one-half years.² Sorting through vast amounts of information to find the required insight is a problem faced by the military, government, and industry. In fact, this explosive growth of information *requires* the development of new technologies and management techniques to effectively lead any large organization.

Military commanders are faced with a deluge of information about operations, finance, logistics and a myriad of other areas for which they are ultimately responsible. The search for insight is outstripping the ability to control the information torrent using current management practices. In fact, this problem will continue to worsen as information growth accelerates. This means that there is an urgent and obligatory need to separate valuable information from the endless supply of interesting but irrelevant information.

At the same time, the Air Force faces an ever-increasing operations tempo. The Air Force is now four times more deployed than it was just 10 years ago.³ Pop-up contingencies around the globe must be dealt with rapidly. These contingencies can range from humanitarian disasters, which require a fast response to save lives, to deploying forces to fight rogue nations like Iraq, Serbia and North Korea. The recent operations in Kosovo and hurricane relief in Central

America have been defined by the lack of one valuable commodity – time. Today, it seems that the CNN factor means that the US Air Force is almost expected to deploy and save anyone in the world in time to make the evening news.

So, commanders are faced with short reaction times and a glut of information. How can military decision-makers, already overtaxed with charts, briefings, e-mail, position papers, and phone calls, hope to get the right information to make the right decisions at the right time?

Knowledge management enables commanders to control the flood of information and gain unprecedented insight into their organizations. Rather than drink from a firehose, commanders and their senior staffs can determine what information they need to do their jobs and easily access that up-to-date information. The Air Force will be able to use its technological edge to fully exploit information superiority and evolve into an ever more potent force.

This paper is primarily about how to better manage a large organization. Although many people within an organization will reap tremendous benefits from knowledge management, this paper focuses on commanders and their senior staff. Specifically, this paper is directed at organizations like Major Commands (MAJCOMs), Numbered Air Forces (NAFs), Wings and Aerospace Expeditionary Forces (AEFs).

This paper covers four areas. The first area focuses on knowledge management as a tool that enables commanders to gain a better insight into their organizations while reducing the overflow of information. The second area examines intranets and thin client architectures, the technological solutions to the knowledge management problem. The third area provides examples of two knowledge management initiatives and describes their benefits. The last area contains recommendations for Air Force implementation of knowledge management solutions.

Notes

¹ Thomas Davenport, *Working Knowledge* (Harvard Business School Press, 1998), ix

² Mortimer B. Zuckerman, "The Times of Our Lives" *U.S. News and World Report* (Dec 27, 1999) 68

³ General Patrick Gamble, "The Air Force's Millenium Metamorphosis" *Remarks for the Alaskan Birthday Balls* (18 Dec 1998) 2

Part 2

Knowledge Management

Information becomes knowledge only when it is in the hands of somebody who knows what to do with it.

— Peter F. Drucker, Dean of American business and management philosophers¹

What is Knowledge Management?

To understand the field of knowledge management, it is easiest to take a step back and look at what makes up knowledge and then look at how that knowledge can be managed. Information is gathered in the form of *data*, which are single, discreet facts.² For instance, the minimum mission capability rate for the F-16 is 85%. That means that at least 85% of the F-16's in a squadron should be ready to fly. So, the fact that the mission capable rate for a squadron is at 87% for this month is a piece of data. *Information* is the aggregation of individual pieces of data. A trend line showing the F-16 mission capable rate dropping from 92% to 87% over the last year is information. *Knowledge* consists of putting together disparate pieces of information to gain insight or a higher level of understanding on an issue. Coupling a trend line that shows an increasing shortage of F-16 engines with the mission capable rate line would show that the engine problems were causing the decline in F-16 availability rates.

A knowledge management system is a means to gather, sort, fuse and disseminate knowledge. For instance, a book is a good example of how one person passes knowledge on to

others. A simple example of knowledge management is the Dewey Decimal System. That system lets people key on author, title or subject to find books in a library. The Dewey Decimal System allows people to find knowledge, information, or data. While the Dewey Decimal System and the books it catalogues are very valuable, there are also significant limitations on using books to store information.

The limitations on books, libraries and the Dewey Decimal System include:

1. You have to go to the library to get the book.
2. Only one person can read a book at a time.
3. Choosing the right book can be difficult. Using Dewey Decimal System to find a book, and then reading the table of contents of a book is very time consuming.
4. The information within books is not updated as time goes by.
5. Books are expensive.

Modern computer technology solves many of those problems by allowing people to quickly access different kinds information from their desks. Unfortunately, there is no modern equivalent to the universal Dewey Decimal System. While finding specific information is possible, aggregating and using information from different sources is difficult. Additionally, modern technology has caused an explosion in the amount of information available. The computer has allowed us to collect raw data and easily convert it into information. For instance, one of the Web search engines took just 0.12 seconds to find 44,500 hits for the F-22. This vast amount of information generated by the information revolution is swamping commanders. For instance, the Commander of Pacific Air Forces (PACAF) averages about 300 pages to read everyday.³ That overwhelming volume doesn't even include all his briefings, phone calls and meetings in which additional information is passed to him.

The field of knowledge management can solve those problems through a system that provides access to *internal* organizational information in a timely, inexpensive and simple manner. This development is required to reduce the vast amount of information available to a manageable level.

The 21st Century Problem

Of course, this problem isn't faced only by the military. In fact, corporate CEOs also find managing the vast glut of information to be a major problem. For instance, the Malcolm Baldrige National Quality Award Foundation found that CEO's ranked improving knowledge management their second priority.⁴ Similarly, a PricewaterhouseCoopers survey of CEO's found that 97% of senior executives believe knowledge management was a critical issue for them.⁵ Another example of how fast the knowledge management field is growing is demonstrated by the fact that government spending on knowledge management is projected to grow from less than \$400 million in 1999 to over \$6.3 billion in 2003, an increase of 1,500% in only four years.⁶ Clearly, large organizations are trying to solve the very difficult problem of managing large amounts of information.

Knowledge management crosses a wide range of disciplines. Obviously, new computer hardware and software are required to process and move ever-increasing amounts of data. There are also a number of other techniques that are being developed to help manage knowledge. They include data warehousing and data mining, which are data management techniques to store and access vast amounts of information. Sophisticated data mining techniques are able to find trends and correlations that humans could never find.⁷ After all, that is exactly what computers are very good at, quickly processing vast amounts of data.

There are also information architects who determine the means to analyze and present data in ways that are easily understandable and provide the most insight. Their job is to integrate large amounts of information from disparate sources and provide a truly comprehensive look at any aspect of an organization.

Richard Saul Wurman, an honored information visionary describes the term he coined. He defines an information architect as an “individual who organizes the patterns inherent in data, making the complex clear.”⁸ It’s “the emerging 21st century professional occupation addressing the needs of the age, focused on clarity, human understanding and the science of the organization of information.”⁹

Information fusion is another field of knowledge management. It encompasses using modern technology to combine information to present historical data, discover problem areas and predict future performance. The process of information fusion allows data to be combined and recombined to ferret out useful trends.

For instance, a NAF commander could get up-to-date information on all aspects of a base at a glance -- from the status of all the aircraft, to base construction programs, to the current financial situation. A different cut of the information could reveal the status of all F-16’s in the theater to determine if there are any overarching problems for that particular aircraft.

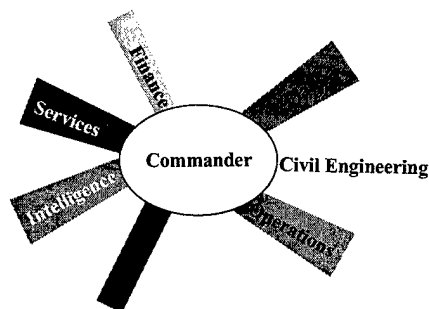


Figure 1 Traditional Information Flow to the Commander

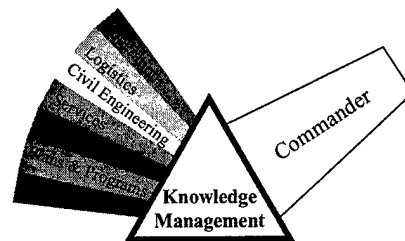


Figure 2 Using Knowledge Management to Fuse Information for the Commander

This paper focuses on a particularly high payoff topic of the knowledge management universe, using intranets and World Wide Web technology to provide a simple to use system that gives decision makers the right information at the right time. This type of knowledge management is called Web-based management.

Notes

- ¹ Eastman software brochure, "Corporate Profile" *KM World* (Sep 1999) supplement
- ² Thomas Davenport, *Working Knowledge* (Harvard Business School Press, 1998), 2
- ³ Lt Col Kenneth Merchant, Executive Officer to the PACAF Commander (Mar 00)
- ⁴ Lee Velker, "Zisman on Knowledge Management" *KM World*, (Oct 1999) 20
- ⁵ Gary Abramson, "On the KM Midway" *CIO Enterprise, Section 2* (May 15, 1999) 64
- ⁶ "Growing Government Presence in KM" *KM World* (1999)
- ⁷ Wendi R. Bukowitz, "Book Excerpt: The Knowledge Management Fieldbook" *CIO Enterprise, section 2* (October 15, 1999) 82
- ⁸ Richard Saul Wurman, *Information Architects* (Graphis Inc 1997) cover
- ⁹ Ibid.

Part 3

Web-based Management

Bill Gates recently spoke to over 100 global CEO's about managing knowledge.¹ He predicts the use of a "digital dashboard" where people can "obtain information within 60 seconds of posing the question."²

The Internet and the World Wide Web

The Internet and the World Wide Web have undoubtedly revolutionized the way information moves throughout the world. The advent of high-power desktop computers and the networks that connect them kicked the Information Age into high gear. Vast amounts of information are now available at your fingertips in minutes. Many people now are familiar with how to use the Web and it's estimated that 38% of all households have access to the Internet.³ You can buy a car, get a loan, obtain insurance, and even get directions to the dealer, on the Internet.

Government and industry are beginning to use this powerful tool to manage the internal information explosion occurring within their organizations. If this ability to easily gather and display information could be turned inward to manage an organization, then unprecedented insight can be gained by that organization. Using Web technology as a new internal knowledge management system can give decision-makers the information they need to lead their organizations.

Simply put, Web-based management takes advantage of the Internet and World Wide Web technology to manage information and knowledge more effectively. Web-based management enables commanders and their staffs to dam the flood of information. Just as a hydroelectric dam stops floods and produces power, Web-based management stops the flood of information and produces management insight.

First a few definitions to make the jargon clear. The Internet is made up of computers, routers, and services that form a network to share information.⁴ The Internet can be used for a number of things, including sending and receiving e-mail, surfing the World Wide Web, chatting online and video conferencing. The World Wide Web is a portion of the Internet that allows information to be easily viewed using graphics.⁵ It is interactive and has hyperlinks. One of the advantages of the Web is that it is easy to develop new Web sites; tens of millions of Web sites exist today.

To fully understand the fundamental changes that Web-based technologies bring, it is necessary to look at exactly how it works and why it is essentially different from any computer management system that has come before. The power is in the Web browser.

Intranets

The first key to designing a Web management system is setting up an intranet. An intranet is a network within an organization that is connected to the Internet through security features like firewalls.⁶ The intranet allows secure online sharing of information within an organization. This information could include financial data, project status, readiness reports, and any other information requiring distribution within an organization. Intranets can be connected to the Internet through a Virtual Private Network.⁷ The Virtual Private Network (VPN) uses

encryption, access control, and authentication to make secure connections to the Internet.⁸ The benefit of a VPN is that it allows people at different locations to access the same data. This ensures consistency throughout an organization. For instance, a MAJCOM, NAF, and Wing could review identical data on sortie status or year-end financial obligations. There doesn't have to be three different systems for managing the same data.

Thin Client Architecture

To fully understand the flexibility and adaptability of new technologies, it is important to understand the advances in networks. First-generation networks were simply dumb terminals connected to mainframes.⁹ Basically, everyone worked on one computer. The system most commonly used today is the second-generation network called the two-tier client/server model.¹⁰

The two-tier model works by storing an application on the user's computer, also known as the client.¹¹ The application could be the software used to determine financial status or any other shared information. Updated data is placed on the server and each user retrieves it to their desktop computers using their application (Figure 3). Users are able to view and analyze the data at their computer. For instance, if your financial analyst wants the current financial report, that person starts up their financial software, accesses the new data on the server and reads it. This is how most networked information moves within the Air Force.

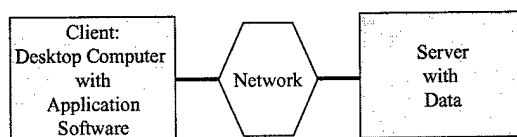


Figure 3 Traditional Two-tier or Client/Server Model

There are two problems with the two-tiered model. First, in order to add any new capabilities, the software must be updated causing software configuration problems. The effort it took to update Air Force systems from Microsoft Word 95 to Microsoft Word 97 serves as an excellent example of the organizational difficulties that is created when trying to update everyone at once. For instance, many people could not open Word documents because they had the wrong version of the software. Second, only people who have loaded that particular software application can read the data, meaning that access to the data is restricted to the functional stovepipes.

The new model is called the thin client model or three-tiered architecture.¹² A Web browser like Microsoft's Internet Explorer or Netscape Navigator is based on the thin client model. The users desktop computer only stores the interface logic, like the Web browser. The user then connects to an applications server where the software to run and manipulate the data is stored. The third part of the three-tiered model is the back-end tier that holds the data (Figure 4). A good example of the back-end tier is a data warehouse server.¹³

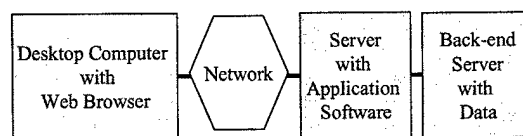


Figure 4 New Three-tiered or Thin Client Model

Although the thin client model doesn't sound very impressive, it gives users a vastly easier and less costly system. The powerful advantage to the thin client model is that it allows everyone in the organization to access data by using only a Web browser. Costs are significantly reduced because software upgrades for the different data management systems are only needed on the

second-tier servers. This way, only the experts are required to update the system. For instance, although there may be 1000 users in an organization, there might only be 50 second-tier servers. So, the experts only have to load software updates on those 50 second-tier servers and not on the 1000 user computers. According to the GartnerGroup Inc., a move toward thin client networks can cut support staff costs 80% by eliminating most of the assistance needed from the help desk.¹⁴ This also means that individuals scattered around the globe can quickly access the same information.

In the near term, it is easiest to convert two-tier legacy systems to thin client systems by using middleware. Middleware is software that connects the legacy software to the web-browser. It allows individuals to access data without having to use the functional stovepipe software. Fortunately, in the future, most software systems will be written to be Java friendly, allowing easy access for the Web browser without the use of middleware.

This doesn't mean that Web-based management is something that will occur overnight. Instead, Web-based management is a goal that an organization should evolve toward. The speed of the evolution depends upon system access, legacy system replacement costs, and middleware programming costs.¹⁵

Thin client architecture will allow commanders to access information much more quickly than was previously possible. Instead of receiving data that is months old, information will be continuously updated and readily available at their fingertips. Another key benefit of the system is that all commanders and their senior staffs throughout a MAJCOM are sharing the same data.

At the same time, individuals within a functional area will be using the same data. The financial people throughout a command can access and discuss the same financial data. The same applies to the operations, logistics, civil engineer, personnel systems and all the other

functional areas. Additionally, as smart and expert search engines come online, fast searches for data will be much easier to accomplish.

Future Capabilities

The other advantage of a Web-based management system is its adaptability and flexibility. It can inherently grow as new technologies emerge. Because Web technology is designed to be a general use system, it can be adapted to work with a wide variety of software. Additionally, there are a number of new technologies that are being designed that will make knowledge management systems much more powerful than what is available today.

To start with, Tim Berners-Lee, who invented the World Wide Web less than 10 years ago, believes that the Web will be much more powerful in the near future. He says, "in the next 10 years Web surfers will be able to swiftly connect to complex databases and customize information searches."¹⁶ He predicts the Web will be able to conduct complex searches from a vast array of different sources.¹⁷ Instead of giving you a long list of different sites to research, new web technologies will be able to give you the answer to a direct query that puts together information from different sources.¹⁸ The Web should become much more user friendly, getting away from today's difficult to use search engines. Natural language processing will allow people to search the Web using plain English.¹⁹

Smart and expert systems also are starting to come online. Collaborative filtering and artificial intelligence use advanced algorithms to determine and remember a person's preferences while conducting searches.²⁰ Then, as a person conducts searches, the smart engine is able to make a better match.²¹ The more a person uses the system, the smarter the system gets.

Work has already begun on Internet2. Begun in 1996, Internet2 will not be a stand-alone system, but rather a system that is integrated into the Internet as we know it today. The consortium of over 200 universities, high-tech companies and government researchers is working to develop the hardware and software that will enable a much higher bandwidth of data to flow through the Internet.²² The goal is to allow huge amounts of data to be transmitted in near real time.

In the next decade, Web technologies promise to bring tools and bandwidth that will make the Internet much more user friendly. As the hardware and software becomes available, people will be able to quickly find the exact information they need. This will not only save huge amounts of time, but also greatly increase productivity as diverse sources of information can be combined into useful knowledge.

Web-based Advantages

The bottom line is that Web-based management using thin client architecture technologies allows real time information from many disparate sources to be shared among a wide variety of people across vast distances. Here is a summary of the advantages of the thin-client networks:

1. The thin client architecture system can be accessed from anywhere on the globe without continuous software updates. Restrictions can be ensured by a multi-level security system.
2. This architecture is designed for a high level of interoperability. The use of the Java programming language and the rise of middleware to access databases allows nearly all current and emerging software systems to be integrated. Specialized and stand-alone systems will be replaced or adapted to work through the Web.

3. The system inherently provides for both growth and flexibility. When new hardware and software is developed, it is integrated into the Web-based management system.
4. The system is easy to use. Most people are now familiar with how to use Web pages. Training on complex systems is no longer needed.
5. The system is relatively low cost. It frees resources from help desks and allows for further knowledge management development.
6. The last key advantage is portability. Good ideas and Web-based products are easily transferable across the Air Force. Within hours, an application developed at one base can be sent throughout the Air Force and installed, making the data available to everyone.

Web-based Challenges

Of course, there are some significant challenges to implementing a web-based management system. A list of these difficulties include:

1. Web-based management is immature.²³ Web-based technologies are not fully developed and the standards are still changing.²⁴ Additionally, integrating legacy systems through the use of middleware is challenging and will cause interoperability problems.²⁵
2. Security is also an issue. Protecting information from unauthorized access will always remain a serious challenge.
3. It is very difficult to calculate a return on investment for web-based management systems. It is hard to actually prove that the money spent on a knowledge management system will produce a greater long term cost savings through increased productivity.

4. There must also be a cultural change within the organization to fully realize the advantages of a Web-based management system. If the organization doesn't adapt to take advantage of the new capabilities through new management practices, then a Web-based management system will not be effective.
5. Finally, Web-based management bets on the future of technology to realize its true potential. Without future standards, advanced search engines and much broader bandwidth, web-based management will never realize its potential.

Notes

- ¹ "Gates Talks Knowledge Work to CEO's" *KMWorld* (Jun 1999) 36
- ² Ibid.
- ³ Gregory Thomas, "Getting to Know You.com" *CIO Enterprise, Section 2* (Apr 15, 1999)
- 48 ⁴ Ibid.
- ⁵ Ibid.
- ⁶ Ibid.
- ⁷ Sean Harnedy, *Web-based Management for the Enterprise*, (Prentice Hall PTR, 1999) 11
- ⁸ Ibid.
- ⁹ Ibid. 21
- ¹⁰ Ibid. 21
- ¹¹ Ibid. 21
- ¹² Ibid. 21
- ¹³ Ibid. 22
- ¹⁴ Anne Stuart, "You Can Never Be Too Thin" *CIO Web Business Section 2* (August 1, 1999) 18
- ¹⁵ Sean Harnedy, *Web-based Management for the Enterprise*, (Prentice Hall PTR, 1999) 34
- ¹⁶ Dennis McCafferty, "He Created the Web. Now He's Fixing It" *USA Weekend* (Oct 29-31 1999) 4
- ¹⁷ Ibid.
- ¹⁸ Ibid.
- ¹⁹ Megan Santosus, "Say What?" *CIO Web Business Section 2*, (September 1, 1999) 48
- ²⁰ Todd Datz, "How to Speak Geek" *U. S. News and World Report*, (November 15, 1999)
- 108 ²¹ Ibid.
- ²² Rochelle Garner, "Internet2 ... and Counting" *CIO Web Business, Section 2* (September 1, 1999)
- ²³ Sean Harnedy, *Web-based Management for the Enterprise*, (Prentice Hall PTR, 1999) 35
- ²⁴ Ibid.
- ²⁵ Ibid.

Part 4

Real World Solutions

Both government and business are developing the new technologies and management principles to make knowledge management work. Although the field is only a few years old, many Fortune 100 companies have already appointed Knowledge Managers at the senior level within their corporate headquarters. Additionally, several organizations have taken advantage of Web-based management to improve their operations. Here are a few examples of how both corporate America and the Air Force are using thin client architectures to enable Web-based knowledge management.

SneakerNet

Nike Inc., a \$9 billion-dollar-a-year company, has developed a Web-based intranet to support their employees.¹ This management tool is called the Global Product Information Network or GPIN.² Because of Nike's worldwide presence, Nike found that it was very difficult to keep people, both within their headquarters and across the globe, updated on everything from new product designs, to manufacturing, to the latest sales data.³ This Web-based intranet system is designed to provide information on company products, not company news or general information. It is used as a management tool so that employees around the world can get access to up-to-date information.⁴ For instance, instead of meetings being used to pass on information,

company managers now use meetings to make decisions, because everyone already has the same updated information.⁵ Because new product designs are highly confidential, the system is restricted to only those individuals who need the information.⁶ GPIN uses Web-based technology and middleware to tap into existing legacy systems and allow information to be pulled dynamically from various sources onto a Web page. For example, a Web page can show a color photo of a running shoe, plus information about materials used, target audience, and price. The system was also relatively inexpensive to produce, costing only \$3 million to develop.⁷ The Nike GPIN system is an excellent example of how Web-based management enables information fusion and unprecedented access to previously hard to get knowledge for individuals scattered around the globe. The system allowed them to reduce product development timelines and was one part of an overall program that allowed Nike to grow from a \$3 billion a year company to a \$9 billion a year powerhouse in only 3 years.⁸

PACAF Knowledge Management

In a Headquarters, information is both the product and the medium. It's our only commodity. Simply put, Headquarters Command and Control involves receiving, crunching and disseminating information as clearly and as efficiently as possible

— General Patrick Gamble, Commander, Pacific Air Forces⁹

PACAF Headquarters began several new knowledge management initiatives during 1999. One of those systems is designed to use Web-based management to give the PACAF Commander and headquarters senior staff insight into a broad range of items. In the near future, the system will also be linked to the four NAF and 10 Wing Commanders in PACAF as well as their senior staffs.

Design Considerations

The PACAF knowledge management system provides quick access to a wide a range of issues. The system is based on thin client architecture technology, so that a Web browser is all that is needed to access all the information in the system. It is also designed to be inherently flexible so that it can adapt to new technologies, change with the organization and grow to include senior leaders throughout the Pacific. It is a "pull" system; the Commander defines or "pulls" what he needs to see. This contrasts with a "push" system in which subordinates push an overwhelming amount of e-mail and paper copies up to the Commander. The pull system puts the Commander back in control of the information he must see everyday. Instead of being swamped with information by the staff, the Commander now has the opportunity to use his limited time to be more proactive on the issues he believes require his attention.

The simplicity and ease of use of the knowledge management system enables the Commander to quickly review a broad range of issues within 30 minutes. The system is primarily designed to present analysis and decisions, not vast quantities of data. It uses Web links and graphics to quickly display continuously updated information. Additionally, the entire senior staff has access and will be able to tailor the system to meet their individual needs. Top-level information is easy to find, but if more detailed information is needed, the system provides the path to quickly delve into progressively lower levels of information. Because the system ties into existing databases, it now takes much less time to get the right information to the right person.

The mantra for the system is graphics, trends and predictions. Graphics are used to quickly and easily explain vast amounts of data. A picture may be worth a thousand words, but a graph is worth far more than a table full of data. The system also uses information fusion to combine

various types of information into knowledge. Trends are important to show whether or not PACAF is doing well, falling behind or leading the field. Predictions are necessary to understand where PACAF is headed in order to make changes before crossing minimum thresholds. In the past, staff officers had to manually convert the information from the databases into background papers or PowerPoint presentations and then forward that up the chain of command. Now staff officers can spend their time doing analysis, making trend predictions and spotting problem areas. The analysis, trends and problem identification can then be sent forward through the same system, ensuring staff officers are doing less administrative work and greatly increasing their productivity.

An excellent resource on building graphics that are easy to understand are the books by Edward Tufte, the preeminent authority on ways to display information. He is called the Leonardo da Vinci of data for his ability to explain the best ways to present information visually.¹⁰ His books on the visual display of data, how to envision information and how to make visual explanations understandable are key to creating a good knowledge management system. His works provide the basis for how to display any kind of information to make the vast amounts of data generated within a MAJCOM easy to understand.

Available Online

In order to present a clear understanding of exactly what information is available, here is a partial list of the information that is being made available through the PACAF Knowledge Management system. The system will incorporate:

1. SORTS, the Status of Operational Readiness and Training System, which is the standard Air Force system for reporting the readiness of units. The SORTS system was originally developed in PACAF and is now used throughout the Air Force. The

system uses thin-client architecture to provide the status on operational readiness of PACAF squadrons.

2. The Base Brief which is an excellent example of information fusion. It integrates a vast amount of information about a base from each functional area. Seventeen directorates provide the graphics, status, trends, issues, and predictions for every aspect of a PACAF base. This information is only pulled from existing sources.
3. The status of current Air Force operations. These operations include the missions enforcing the no fly zones over Iraq, the deployments to Bosnia, or any other contingency operation.
4. The central AEF deployment schedule located at HQ Air Combat Command. This schedule includes the master plan for integrating PACAF units into the 10 AEFs.
5. The PACAF Logistics Indicators show the status of resupply and maintenance of every major weapon system in the theater.
6. The financial status of PACAF and each Wing includes information on financial obligations, the flying hour program and the priorities of funding requirements.
7. PACAF's current ability to flow the Time Phased Force and Deployment Data List (TPFDDL) and the limiting factors (LIMFACs) to supply a major theater war.
8. Civil Engineering construction programs and other major issues detailing if runway and building repair or new construction programs are meeting cost and schedule goals.
9. The current status of taskings from CINCPAC, the Secretary of Defense, Air Staff and Congress.

10. The Wing schedules which include information on exercises, such as Cope Thunder, as well as squadron deployments and inspections.
11. Quick links to current news and economics, statistics and maps of the Pacific theater,
12. Numerous special issues such as preparation for Y2K, force protection initiatives, rated manning issues, and current CORONA issues.

Requirements

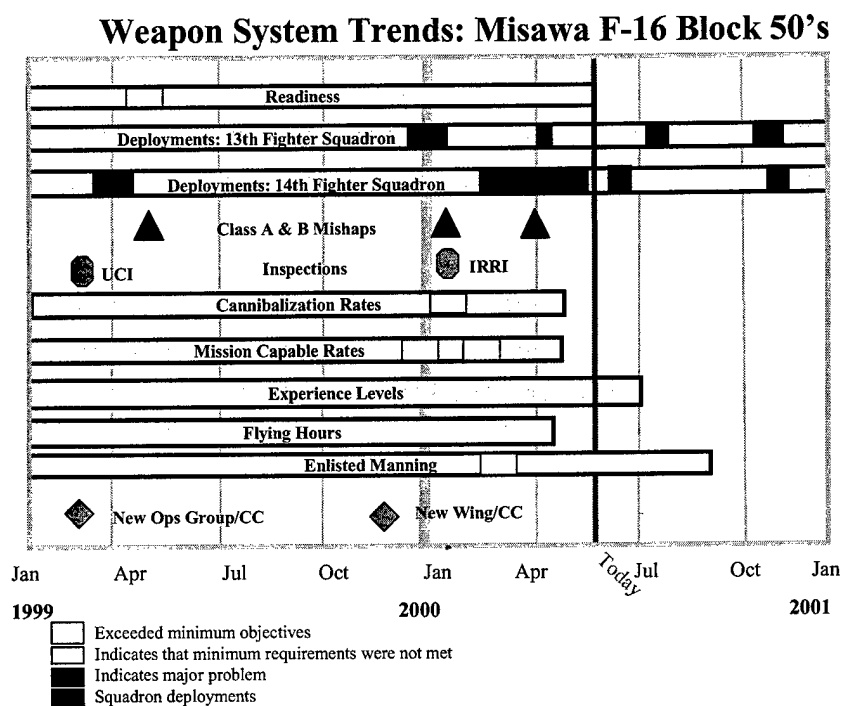
It took 7 months, \$500 thousand and two people working part time in the Commander's Action Group to get the system operational. The \$500 thousand paid for the computer servers and contracted technical support to design the Web-based system as well as the middleware to connect it to the existing databases. It was easy to select items to get the system operational and then evolve the system over time to incorporate the more difficult items. The biggest challenge was writing the middleware to get Web-based access to the legacy systems. In order to keep costs down, the system was designed to tie into databases that were already available. This ensured that there was minimal extra time levied upon each directorate to make any updates. The philosophy was to create a system of systems in order to provide an unprecedented look into PACAF.

Information Fusion

As mentioned, information fusion is a valuable benefit of the Web-based knowledge management system. Information from disparate sources can be quickly combined to gain insight into many issues. Research that once took weeks to complete can now be done in hours. Instead of making numerous phone calls and sending out e-mails to find the person who is the

“keeper” of information and then spending time to physically collect the right information, the Web-based system provides quick access to most information.

For instance, in an effort to understand the problems with the increase in operations tempo, a hyperlinked chart was created that showed a wide variety of factors and possible consequences. This chart was assembled in only a few hours and contained hyperlinks to all the back up data.



NOTE: Chart for illustrative purposes only. Because this paper is unclassified, actual data is not used.

Figure 5 Example of PACAF Information Fusion

This is simply one example of how previously very hard to assemble information can be brought together very quickly. The chart combines operations tempo, maintenance, training, logistics issues, safety, and many other factors in an effort to identify correlations and squadron

stressors. Instead of searching for individual pieces of data throughout a headquarters, the PACAF system easily saved weeks of time by providing most of the needed information.

Challenges

There were a number of challenges to the successful development of the PACAF knowledge management system. These included security issues, development of the middleware, and making the system easy to use.

Obviously, the unauthorized access to an Air Force information system is a major concern. To ensure that the information is restricted to individuals with the need to know, the system contains multi-layer security precautions. Because of the difference in classifications, part of the system resides on the unclassified network while all sensitive information stays on the Secret network, otherwise known as the SIPRNET. Additionally, a number of other safeguards are integrated into the PACAF system. Firewalls are established to keep unauthorized outside users from accessing the PACAF internal network. Advanced user authentication, intrusion detection and other security measures are in place to restrict unauthorized access. Security will remain a major consideration and a risk analysis must be completed to ensure that the benefits outweigh the risks.

Integrating existing information into the PACAF knowledge management system has continued to be very challenging. Although some systems were easy to incorporate, others are much more difficult. Development of the middleware accounts for most of the development costs. Additionally, because of the wide variety of legacy systems, the process to incorporate all of them into one system will be a long-term project.

The last major problem is pulling the right information out of the vast quantity of data generated in a MAJCOM, yet still making the system easy to use. Trying to determine exactly

what to make available online at a glance and then determining how to provide access to more detailed information is very challenging. In short, trying to make something simple to use is very complex.

Notes

¹ Sari Kalin, "SneakerNet" *CIO Web Business, Section 2* (August 1, 1999) 32

² Ibid.

³ Ibid.

⁴ Ibid.

⁵ Ibid. 34

⁶ Ibid.

⁷ Ibid.

⁸ Ibid. 32,34

⁹ Lt Gen Patrick K. Gamble, *Clausewitz in Cyberspace* (1997) 2

¹⁰ Edward Tufte, Advertisement for the authors books. Quote attributed to NY Times

Part 5

How to Know Ourselves

Know your enemy and know yourself, in one hundred battles you will never be in peril

- Sun Tzu¹

Sun Tzu, the preeminent military philosopher whose works still apply over 2,500 years later, explained that it is necessary to understand both your enemy's capabilities as well as your own. Today, the US military refers to the phrase "know your enemy and know yourself" as information superiority. The US Air Force does an outstanding job of gaining information about our adversaries. The use of satellites, unmanned aerial vehicles, AWACS, and JSTARS provide a tremendous amount of data. In fact, the US military spends tens of billions of dollars per year on gathering, processing and synthesizing information to cull the vital facts about locations where the US military might have to deploy for contingencies.

It is now time to apply a few million of those tens of billions of dollars to the other side of information superiority, knowing ourselves. It is time to begin actively managing the knowledge we already have. The information we gather on ourselves is useless if people can't access it, or if they are overwhelmed with irrelevant information.

Besides HQPACAF, many Air Force organizations have begun to develop various styles of knowledge management systems. These systems cover a wide variety of philosophies and span various levels of technological maturity. For instance, Headquarters Air Combat Command

(ACC) uses a Microsoft PowerPoint based system to flow interest items to the ACC Commander. He also is kept informed on a number of different top issues using an e-mail-based system.

Units at the sub-MAJCOM level are beginning to use knowledge management systems, too. Air Armament Center has a robust program called the Executive Management Information System (EMIS) which uses Web-based management to provide a broad range of information to the Air Armament Center key leaders and operators.²

Unfortunately, the MAJCOMs, Centers and other lower- level organizations developing knowledge management systems are doing so independently. There is no Air Force consensus that knowledge management is required in order to grapple with the vast quantities of information now available. Additionally, there is no overall Air Force organization that is coordinating activities or acting as a lead agency. This lack of effort is due mostly to ignorance. Since it doesn't show up on the organizational chart, knowledge management does not have an advocate within any organization. Instead, visionary individuals at various organizations have sought new technologies, information about corporations that battle this problem, and approval for knowledge management initiatives.

A Web-based knowledge management initiative provides improved management. Commanders will be able to make better decisions about resource allocation. MAJCOM Directors of Finance will be able to put limited dollars where they are needed most. The huge savings in man-hours and improved efficiency will pay for the knowledge management system very quickly. For instance, the Navy MAJCOM for operations in the Pacific, PACFLT, has demonstrated savings of 18,000 man-hours per month for a system that only cost \$3 million to

develop.³ Their system linked 250 databases together across organizational and functional boundaries.⁴

Recommendations

These recommendations are for establishing a philosophy and a process, not just building a product. Managing knowledge needs to become a fundamental tenet of information superiority. Building a knowledge management system will not occur overnight. Instead, it will evolve towards a new way of doing business. To make that happen, the Air Force needs to establish a lead agency, appoint knowledge managers at the MAJCOMs, and build a robust network.

Establish a Lead Agency

The Air Force needs to appoint a lead agency for implementing and coordinating knowledge management activities. The purpose of the lead agency should not be directive, because ingenuity and flexibility are one of the greatest benefits of a knowledge management system. Instead, this lead agency should coordinate the efforts of the various MAJCOMs and serve to cross-flow good ideas. The benefit of the Web-based knowledge management system is that it is not a monolithic system. Bits and pieces that work well at one MAJCOM can quickly be loaded and used by other MAJCOMs. This also prevents MAJCOMs from reinventing the wheel or pursuing technologies that can't be integrated throughout the Air Force.

ACC should take the responsibility as the overall knowledge management lead agency because they have the most robust network infrastructure and technical experts. The system can be developed for use by the ACC Commander, senior Headquarters staff, NAF, and Wing Commanders. Because of its location in the United States, ACC will have the fewest problems

with time zones, language, security, and the availability of American computer experts and technology.

An operational command, ACC can also begin the integration of warfighting information into an overall knowledge management system. Eventually, a seamless network of information could tie the Air Operations Centers and fighting commands to the supporting commands.

Appoint Knowledge Managers at MAJCOM Headquarters

All MAJCOMs should appoint a knowledge manager who is a field grade officer to begin the process of integrating the vast and growing amount of information within the Command. The job, first and foremost, concerns the knowledge required to command a MAJCOM, and is not about the technical details. The Knowledge Manager won't be responsible for updating individual systems, but is instead responsible for integrating all stovepipe systems together into a seamless Web. Job responsibilities will also include determining how to use Web-based technology to make the information easy to access. The Knowledge Manager will have a difficult job. It will entail understanding all the information available within a MAJCOM and then developing techniques to fuse this information into one architecture. This system must offer quick access, be simple to navigate through, and provide the information in ways that are easy to understand.

The MAJCOM knowledge management office should be small, consisting of about three individuals who have relatively easy access to the MAJCOM commander and senior staff. Technical support should be contracted and cost about \$500 thousand annually. This expertise is required to write the middleware and assist in developing the information architecture.

Although a strong computer background is beneficial, it's more important for the Knowledge Manager to understand what the Commander and senior staff needs to know. So, the

Knowledge Manager should work directly on the Commanders staff. Although some people would naturally assume that a knowledge manager should work in the Communications Directorate (SC) because the job deals with Web and computer technology, that is not actually a good fit. The SC organization is responsible for the hardware, software, and networks. In short SC builds and maintains the pipes through which information flows. The Knowledge Manager, on the other hand, is interested in the knowledge that flows through the pipes. Additionally, the Knowledge Manager will have to master the principles of information fusion and the visual display of knowledge to make the systems user friendly.

The knowledge manager should be responsible for integrating geographically separated units, such as the NAFs, Wings, and other large organizations, into the knowledge Web.

Establish a Robust Network

It is beyond the scope of this paper to go into much detail, but building a robust network is critical to moving information throughout the Air Force. Current Air Force planning and budgeting for building this computer network is inadequate. The Navy has developed a plan called IT-21 to provide enough bandwidth to take care of their information needs for the foreseeable future. They budgeted the funds to build a network to connect the fleets and shore installations. The Air Force must establish a realistic plan for either building or obtaining access to a robust network. This plan must program enough funding into our budget request to ensure enough bandwidth to manage Air Force computer information needs.

Future Benefits for the AEF

In the future, a knowledge management system will provide a direct connection between the Joint Forces Air Component Commander (JFACC), his staff, and the supporting commands. The

JFACC will then have the supporting information needed to more effectively fight a war. At the same time, the supporting MAJCOM Commander will be tied into the JFACC's requirements and can ensure that the logistics flow into the theater of operations is moving smoothly. If there are any problems, the supporting commander can move quickly to solve them. One only has to look at the possibility of a sudden war in Korea and the massive airlift requirements it would generate to understand that the JFACC will need all the support he can get.

In the same way, a knowledge management system also will be extremely beneficial to the AEF Commander and staff. AEF Commanders have an especially difficult task because the units assigned to them are scattered across the globe and not under their direct control until sent overseas. The system will provide up-to-date information about the AEF units as they spin up through their training cycles. This will be very easy to do, because it is the same information that the MAJCOM, NAF, and Wing Commanders access.

Additionally, the AEF may be deployed to a wide variety of locations. Because the AEF's are designed to be the standby force, time will become a very valuable commodity. When faced with a quick deployment back to Southwest Asia, or to another small contingency, the AEF commander and staff will need the right information quickly. A knowledge management system can provide the status of the infrastructure at the deployed location. It can tell the AEF Commander what equipment is permanently stationed there and what must be airlifted in.

In short, a knowledge management system lets AEF commanders use existing MAJCOM systems to tie directly into how well the units they will employ are spinning up and allows them prepare for many of the possible deployed locations. Once deployed it also gives them a direct link back with higher headquarters.

The Ultimate Goal – a Seamless Web

Eventually, a system of systems can be tied together. This will integrate the warfighters with the supporting commands and the intelligence community to provide a Complete Operational Picture. True information superiority will give commanders and their staff's unprecedented insight into all aspects of warfighting. Combining America's ever increasing knowledge gathering prowess with an ability to design networks that are truly user friendly will give the US Air Force an unmatched ability to respond quickly to any crisis, from a major theater war to small humanitarian emergencies.

Notes

¹ Sun Tzu, Translated by Samuel B. Griffith, *The Art of War* (Oxford University Press, 1963) 84

² EMIS brochure, 996th Communications Group, Eglin AFB

³ Alex Bennet, "Knowledge Management: Unlocking the Poetential of our Intellectual Capital" *Chips*, (Dept of the Navy Chief Information Office, Winter 2000) 7

⁴ Ibid.

Part 6

Conclusion

I pointed out to you the moon and all you saw was my finger.

— African tribe Sukuma¹

Web-based knowledge management will not solve all information challenges. What it does, on the other hand, is establish a philosophy and process to manage the knowledge within an organization. It establishes the technical means and the organizational structure to cope with the ever-burgeoning information explosion. Managing information is very difficult and will be a long term, challenging problem to solve. Our present ad hoc system of managing information is simply not worthy of a world-class military organization. Today, we budget and plan for fuel, bombs, and bullets for our planes. Those are the things that are indisputably necessary for our wings and squadrons to operate. We must do the same thing for our headquarters by planning and budgeting for a knowledge management system. After all, information is the lifeblood of a headquarters. Managing it well is required for a headquarters to operate effectively.

In summary, it's time for the Air Force to embrace knowledge management as a requirement for operating effectively in the 21st century. The Air Force needs knowledge managers and information architects to allow commanders to sort through the flood the information, find the insight they need, and quickly make the right decisions. To be a world class Air Force we must

plan on incorporating knowledge management into our headquarters and make it part of the way we do business.

Notes

¹ Richard Sveiby, Online. Internet, 1 Mar 00. <http://www.sveiby.com.au/BookContents.html>

Bibliography

- Abramson, Gary. "On the KM Midway" *CIO Enterprise*, section 2 (May 15, 1999)
- Bennet, Alex. "Knowledge Management: Unlocking the Poetential of our Intellectual Capital" *Chips*, (Dept of the Navy Chief Information Office, Winter 2000)
- Bukowitz, Wendi R. "Book Excerpt: The Knowledge Management Fieldbook" *CIO Enterprise*, Section 2 (October 15, 1999)
- Datz, Todd. "How to Speak Geek" *U. S. News and World Report*, (November 15, 1999)
- Davenport, Thomas. *Working Knowledge* (Harvard Business School Press, 1998)
- Eastman software brochure, "Corporate Profile" *KM World* (Sep 1999) supplement
- Gamble, General Patrick K. "The Air Force's Millenium Metamorphosis" *Remarks for the Alaskan Birthday Balls* (18 Dec 1998)
- Gamble, Lt Gen Patrick K. *Clausewitz in Cyberspace* (1997)
- Garner, Rochelle. "Internet2 ... and Counting" *CIO Web Business*, Section 2 (September 1, 1999)
- "Gates Talks Knowledge Work to CEO's" *KM World* (Jun 1999)
- "Growing Government Presence in KM" *KM World* (1999)
- Harnedy, Sean. *Web-based Management for the Enterprise*, (Prentice Hall PTR, 1999)
- Kalin, Sari. "SneakerNet" *CIO Web Business*, Section 2 (August 1, 1999) 32
- McCafferty, Dennis. "He Created the Web. Now He's Fixing It" *USA Weekend* (Oct 29-31 1999)
- Tufte, Edward. Advertisement for the authors books. Quote attributed to NY Times.
- Tzu, Sun. Translated by Samuel B. Griffith, *The Art of War* (Oxford University Press, 1963) 84
- EMIS brochure, 996th Communications Group, Eglin AFB
- Santosus, Megan. "Say What?" *CIO Web Business Section 2*, (September 1, 1999) 48
- Stuart, Anne. "You Can Never Be Too Thin" *CIO Web Business Section 2* (August 1, 1999)
- Svieby, Richard. Online. Internet, 1 Mar 00. <http://www.sveiby.com.au/BookContents.html>
- Thomas, Gregory. "Getting to Know You.com" *CIO Enterprise*, Section 2 (Apr 15, 1999)
- Velker, Lee. "Zisman on Knowledge Management" *KM World*, (Oct 1999)
- Wurman, Richard Saul. *Information Architects* (Graphis Inc 1997) cover
- Zuckerman, Mortimer B. "The Times of Our Lives" *U.S. News and World Report* (Dec 27, 1999)